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EXAMINER

PRITCHETT, JOSHUA L

ART UNIT PAPER NUMBER

2872

DATE MAILED: 06/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/092,711

Applicant(s)

HARA ET AL.

Examiner

Joshua L. Pritchett

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2005.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☒ Claim(s) 20 and 21 is/are allowed.
6) ☒ Claim(s) 1-19 and 22-26 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 06 May 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This action is in response to Request for Continued Examination filed May 2, 2005 and Amendment after final rejection filed March 31, 2005. Claims 1, 13 and 15 have been amended as requested by the applicant.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1 and 2 are rejected under 35 U.S.C. 102(e) as being anticipated by Goodwin-Johansson (US 6,456,420).

Regarding claim 1, Goodwin-Johansson discloses a micro-mirror for deflecting incident light comprising a mirror section (part of 30 angled relative to the substrate 12) for reflecting an incident light at a relative angle (claim 17); a hinge section including a fixed section (part of 30 attached to the substrate 12) and a movable section (part of 30 connecting fixed and mirror section extending parallel to the substrate 12) each having a flat surface (Fig. 2); the mirror

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section and the hinge section being integrally formed such that the mirror section extends from the movable section of the hinge section (Fig. 2) and is formed slanted to the flat surface of the movable section of the hinge section (Fig. 2); and a drive means having a bi-morph structure made of two or more materials having different heat expansion coefficients for deflecting the mirror section to change the relative angle to the incident light (claim 20). The examiner interprets the term “formed” as meaning the shape of the MEMS device when no driving force is applied (ie. a state of rest).

Regarding claim 2, Goodwin-Johansson discloses the mirror section is slanted by approximately 55-degrees to the flat surface of the movable section of the hinge section (Fig. 2). The broadest reasonable interpretation of “approximately” shows that the angle of the mirror section shown in Fig. 2 is “approximately” 55-degrees.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-10 and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodwin-Johansson (US 6,456,420) in view of Mitchell (US 6,587,612).

Regarding claim 3-6, Goodwin-Johansson teaches the invention as claimed but lacks the claimed relationship between the thermal coefficients of the two films and the claimed composition of the two films. Mitchell teaches the drive means includes a first drive film (350) provided on one surface of the moving section of the hinge section and a second drive film (340) provided on another of the surfaces of the moving section and have a larger thermal coefficient than the first drive film (Figs. 6A-B; col. 6 lines 45-48). Mitchell teaches the first drive film and the second drive film made of poly-crystal silicon and aluminum (col. 4 lines 23-34). Aluminum and poly-crystal silicon are both conductive materials therefore they are the same "type" of material, but have different resistances to each other. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the film characteristics taught by Mitchell for the purpose of efficiently and precisely moving the mirror section to change the angle of reflection of the incident light.

Regarding claims 7-10 and 15, Goodwin-Johansson teaches the fixed section and the movable section of the hinge section are formed on the first surface of a substrate (32) and the mirror section is formed on a second surface of the substrate (Fig. 2). Fig. 2 shows that the hinge section is formed on the flat surface of the substrate, while the mirror section is formed on the slanted surface of the substrate. Goodwin-Johansson further teaches the hinge section is fixed to the substrate by the fixed section (Fig. 2). Goodwin-Johansson lacks the substrate being made of a semiconductor. Mitchell teaches the hinge section and the mirror section are integrally constructed on a structure film formed on a semiconductor substrate (col. 5 lines 28-35). Mitchell teaches the semiconductor substrate is a silicon substrate (col. 5 line 30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the

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Goodwin-Johansson invention include the semiconductor substrate taught by Mitchell for the purpose of using a material with well-known properties to accurately account for changes in the MEMS device.

Regarding claims 13 and 14, Goodwin-Johansson teaches the invention as claimed but lacks the claimed light emitter and light detector. Mitchell teaches a light-emitting device (20; Fig. 3) and an optical detector (30 and 60; Fig. 3) for detecting a return light of a light irradiated by reflecting at the mirror section and the optical detector located on the semiconductor substrate (Fig. 3). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the emitter and detector taught by Mitchell for the purpose of coupling light from an output source to a receiver.

Regarding claim 16, Goodwin-Johansson teaches the invention as claimed but lacks the bent movable section of the hinge section. Mitchell teaches the mirror section is proved to be continuous from the movable section of the hinge section and to be slanted to the flat surface on the movable section of the hinge section, thereby the relative angle to the incident light in accordance with the change of the movable section of the hinge section (Figs. 6A-B). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the bent hinge section taught by Mitchell for the purpose of changing the angle between the mirror section and the fixed section of the hinge section.

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Claims 11, 12, 17-19, 22-24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Goodwin-Johansson (US 6,456,420) in view of Mitchell (US 6,587,612) as applied to ~~claim~~^{claim 1 and} 15 above further in view of Solgaard (US 6,389,190).

Regarding claims 11 and 12, Goodwin-Johansson teaches the invention as claimed but lacks reference to a silicon nitride film. Solgaard teaches the use of a silicon nitride film as a structured film in a MEMS device (Fig. 5). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the silicon nitride film as taught by Solgaard for the purpose of reflecting any light incident the raised portions of the structured film.

Regarding claim 17, Goodwin-Johansson teaches the invention as claimed but lacks reference to a semiconductor substrate or the use of grooves. Mitchell teaches the hinge section and the mirror section integrally constructed on a structure film formed on a semiconductor substrate (col. 5 lines 28-35). Solgaard teaches forming a first groove having a first skewed surface at a side wall section on a front surface of the semiconductor substrate and a second groove having a second skewed surface substantially parallel to the first skewed surface of the first groove at a position and opposite to a flat surface section around the first groove on a back surface of the semiconductor substrate (Fig. 5), forming structured films at the first skewed surface of the first groove and the flat surface section around the first groove (Fig. 5) and forming the mirror section and the hinge section made of the structured film by removing the semiconductor substrate with etching process after performing a through-hole etching of the semiconductor substrate to make one of the structured films to be a free end at a bottom section of the first groove (Fig. 5; col. 3 lines 37-48). It would have been obvious to a person of ordinary

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skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the groove structure taught by Solgaard to form the structured film for the purpose of attaining a precise and predictable reflection pattern. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the semiconductor substrate taught by Mitchell for the purpose of using a material with well-known properties to accurately account for changes in the MEMS device.

Regarding claim 18, Goodwin-Johansson teaches the invention as claimed but lacks reference to an-isotropic etching. Solgaard teaches an-isotropic etching performed to the first groove and the second groove after forming the first groove on the front surface of the semiconductor substrate and the second groove on the back surface of the semiconductor substrate (col. 3 lines 37-38). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the etching taught by Solgaard to form the structured film for the purpose of attaining a precise and predictable reflection pattern.

Regarding claim 19, Goodwin-Johansson teaches the invention as claimed but lacks reference to an-isotropic etching. Solgaard teaches an-isotropic etching is performed using a mask formed on a photo resist film with uniform thickness (Fig. 5). Solgaard lacks reference to the use of UV ray projection and spray deposition. It is extremely well known in the art to use UV ray projection to pattern a photo-resist mask and to use a spray method to form a layer of uniform thickness. Official Notice is taken. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention

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include the etching taught by Solgaard to form the structured film for the purpose of attaining a precise and predictable reflection pattern.

Regarding claim 22, Goodwin-Johansson teaches the invention as claimed but lacks the substrate being made of a semiconductor. Mitchell teaches the hinge section and the mirror section are integrally constructed on a structure film formed on a semiconductor substrate (col. 5 lines 28-35). Mitchell teaches the semiconductor substrate is a silicon substrate (col. 5 line 30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the semiconductor substrate taught by Mitchell for the purpose of using a material with well-known properties to accurately account for changes in the MEMS device.

Regarding claim 23, Goodwin-Johansson teaches the fixed section and the movable section of the hinge section are formed on the first surface of a substrate (32) and the mirror section is formed on a second surface of the substrate (Fig. 2). Fig. 2 shows that the hinge section is formed on the flat surface of the substrate, while the mirror section is formed on the slanted surface of the substrate. Goodwin-Johansson lacks the substrate being made of a semiconductor. Mitchell teaches the semiconductor substrate is a silicon substrate (col. 5 line 30). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the semiconductor substrate taught by Mitchell for the purpose of using a material with well-known properties to accurately account for changes in the MEMS device.

Regarding claim 24, Goodwin-Johansson teaches the invention as claimed but lacks reference to a nitride film. Solgaard teaches a nitride film is formed as the structured film at the

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first groove and a flat space around the first groove (Fig. 5). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the silicon nitride film as taught by Solgaard for the purpose of reflecting any light incident the raised portions of the structured film.

Regarding claim 25, Goodwin-Johansson teaches the invention as claimed but lacks reference to a nitride film. Solgaard teaches the silicon substrate is selectively removed only to leave the nitride film at the hinge section (Fig. 5). Fig. 5 shows that at the end of the substrate layer only the silicon nitride layer is present. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the silicon nitride film as taught by Solgaard for the purpose of reflecting any light incident the raised portions of the structured film.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Goodwin-Johansson (US 6,456,420) in view of Mitchell (US 6,587,612) and Solgaard (US 6,389,190) as applied to claim 22 above further in view of Ghosh (US 5,910,856).

Goodwin-Johansson teaches the invention as claimed but lacks reference to the etching process. Ghosh teaches the use of an etching process in a MEMS device using potassium hydroxide, hydrazine or EDP water (col. 3 lines 53-58). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to have the Goodwin-Johansson invention include the etching process of Ghosh for the purpose of precise removal of the undesired parts of the silicon substrate.

Allowable Subject Matter

Claims 20 and 21 are allowed.

The following is a statement of reasons of allowance:

Regarding claim 20, the prior art of record fails to teaches or suggest a bi-morph hinge section further comprising a metal film on the structured film constructing the mirror section and the hinge section and forming a reflection film and an electrode pad for supplying current to the reflection film by selectively etching the metal film.

Claim 21 depends from claim 20 and is allowable for the same reasons.

Response to Arguments

Applicant's arguments, see Amendment, filed March 31, 2005, with respect to the rejection(s) of claim(s) 1, 13 and 15 under Mitchell have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Goodwin-Johansson. Applicant argued that the prior art failed to teach a mirror section "formed" slanted to the hinge section. The examiner agreed and a new reference, Goodwin-Johansson, has been used to teach the newly added claim limitation.

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Applicant's arguments, see Amendment, filed March 31, 2005, with respect to claims 9, 10 and 23 have been fully considered and are persuasive. The 35 U.S.C. 112 second paragraph rejection of claims 9, 10 and 23 has been withdrawn.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joshua L. Pritchett whose telephone number is 571-272-2318. The examiner can normally be reached on Monday - Friday 7:00 - 3:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew A. Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

JLP *W*


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SUPERVISORY PATENT EXAMINER